Waterproof footwear with elastic joining strip

The invention relates to a shoe upper and to footwear constructed therewith, the upper being provided with a waterproof and preferably also water-vapor-permeable functional layer to produce waterproofness, and the sole region of the footwear being additionally sealed, and also to a process for producing such an upper and such footwear.

An example of footwear of this type is shown by the applicant's EP 0 298 360 B1, an outer material of the upper being lined with a lining material of the upper having a waterproof functional layer. The outer material of the upper is cut shorter on the end on the sole side than the lining material of the upper, so that an overhang of the lining material of the upper beyond the outer material of the upper is obtained. The overhang is bridged by a gauze strip, the one longitudinal side of which is sewn to the end on the sole side of the outer material of the upper, but not to the lining material of the upper, and the other longitudinal side of which is sewn to the end on the sole side of the lining material of the upper but not to the outer material of the upper. The gauze strip, preferably comprising monofilament fibers, interrupts a water bridge for water passing from the outer material of the upper that has become wet to the sole region. If the border on the sole side of the outer material of the upper were to reach down to the border on the sole side of the lining material of the upper, water creeping down the upper could reach the border on the sole side of the functional layer and from there get into the inside of the lining, which could lead to the space inside the shoe becoming wet. This footwear is provided with a molded-on outsole, which has at the bottom end of the upper such a molded-on height that it embeds the gauze strip and the seam joining it to the

outer material of the upper. The gauze strip has such gauze pores that the outsole material, which is liquid when it is being molded on, can penetrate through the gauze strip and force its way to the overhang of the lining material of the upper and thereby seal the part of the functional layer that is located in the region of the overhang. To maintain the breathability of this footwear, its functional layer is not only waterproof but also water-vapor-permeable. This known construction has proven to be very successful for the production of footwear which is not only breathable but also extremely and reliably waterproof.

One of the problems with this solution is that the upper has a tendency to become folded and distorted in the region of the gauze strip, in particular at those points at which the sole contour of the footwear has a narrow radius of curvature, such as in particular in the region of the toes and heel, which applies most particularly to children's shoes. If the gauze strip extends with its transverse dimension approximately perpendicularly in relation to the outsole, folding occurs, because at most points of the periphery of the end region of the upper the bottom end region of the upper does not rise up perpendicularly from the outsole but with an inclination, which applies in particular to the region of the toes of shoes with a soft outer material. If the gauze strip is located in a region of the bottom end region of the upper that is turned back parallel to the outsole, folding occurs on account of different degrees of curvature of the borders of the end region of the outer material and the end region of the lining material.

The invention is based on the object of remedying this and avoiding folding.

To achieve this object, the invention provides a shoe upper of the type specified in claim 1 and footwear of

the type specified in claim 46. The invention also provides a process for producing a shoe upper of the type specified in claim 57 and a process for producing footwear of the type specified in claim 92. Developments are specified in the dependent claims.

A shoe upper according to the invention comprises a bottom end of the upper, an outer material with a bottom end of the outer material, a waterproof functional layer, which has a bottom end region of the functional layer with a functional layer zone not covered by outer material, a joining strip, which runs in the peripheral direction of the upper, has a top longitudinal side of the joining strip, joined to the end of the outer material, and a bottom longitudinal side of the joining strip, at least partially overlaps the functional layer zone and consists of liquefiable sealing material or of material through which liquid sealing material can flow. The joining strip has at points of curvature of the bottom end of the outer material an arcuate shape corresponding to the local radius of curvature, with different degrees of curvature of the two longitudinal sides of the joining strip, in such a way that, for an arc sector lying in the respective curvature, with a predetermined unitary sector angle, the arc lengths belonging to this arc sector of the two longitudinal sides of the joining strip differ from each other all the more the greater the curvature in the arc sector respectively being considered.

The curvatures of the two longitudinal sides of the joining strip are in this case adapted to the different radii of curvature of the materials joined to the two longitudinal sides of the joining strip.

In one embodiment of the invention, the bottom longitudinal side of the joining strip is joined to the functional layer. In another embodiment of the

invention, a region of the joining strip located between the two longitudinal sides of the joining strip is joined to the functional layer. In a further embodiment of the invention, the bottom longitudinal side of the joining strip is joined to a lining arranged on the inner side of the functional layer. In a further embodiment of the invention, the bottom longitudinal side of the joining strip is joined to a bottom longitudinal side of a second joining strip, which forms an extension of a bottom end of the functional layer and/or of said lining. In a further embodiment of the invention, the bottom longitudinal side of the joining strip is joined to an intermediate sole, for example an insole. The bottom longitudinal side of the joining strip may also be joined to a number of these elements.

In one embodiment of the invention, at points of the bottom end of the upper with convex curvature, the arc length of the top longitudinal side of the first joining strip is longer than the arc length of the bottom longitudinal side of said joining strip.

In one embodiment of the invention, at points of the bottom end of the upper with concave curvature, the arc length of the bottom longitudinal side of the first joining strip is longer than the arc length of the top longitudinal side of said joining strip.

The curvatures of the two longitudinal sides of the joining strip are in this case adapted to the different radii of curvature of the materials joined to the two longitudinal sides of the joining strip.

In this connection, convex and concave mean that the peripheral contour of the bottom end of the upper corresponding to the peripheral contour of the sole that is later to be attached is pre-curved outward or

drawn-in inward, viewed from the middle of the later sole surface.

The terms arc sector, arc lengths and unitary sector angle are explained in more detail at a later point with the aid of Figure 13.

Footwear according to the invention comprises a shoe upper of this type and a sealing material which seals the functional layer zone in a waterproof manner in a sealing material zone that is located in the region of the joining strip and runs around in the peripheral direction of the end of the upper.

In the case of the known footwear of the type mentioned at the beginning, folding of the upper has been caused in the region of the gauze strip because it has not been taken into account that the curved end of the outer material which is joined to the top longitudinal side of the joining strip and the curved material which is joined to the bottom longitudinal side of the joining strip or to a region of the joining strip located between the two longitudinal sides of the joining strip have different arc lengths at points at which the bottom periphery of the end region of the upper has a curvature, which applies in particular in the region of the toes and in the region of the heel, the difference in arc length depending on the degree of local curvature. If, in the previously customary way, use is made of a gauze strip which is not adapted, or is not adaptable, to the different curvatures of the periphery of the end region of the upper, fold-like distortions inevitably occur on account of the different curvatures and curvature arc lengths on the two longitudinal sides of the gauze strip, and these distortions can also be transferred to the material that is sewn onto the gauze strip, in particular the functional layer material, and possibly the lining material, which materials are generally softer than the

outer material. Such folding of the gauze strip may have the effect that sealing material which is intended to penetrate through the gauze strip as far as the functional layer no longer forces its way through adequately or adequately uniformly to the functional layer at the points of the folds, and the sealing of the functional layer zone adjacent to the gauze strip no longer succeeds in a satisfactory way. Folding in the functional layer material and/or in the lining material and/or in the outer material requires thicker layers of adhesive for the cement-lasting in the case of a lasted upper and/or for the cementing on of an outsole, and consequently a higher sole construction than would be required without folding. This also applies to molded-on outsoles, the upright sole side border of which must be molded higher in the case of folding.

It has already been attempted to reduce the problem of folding by using a conical gauze strip with which the top longitudinal side of this gauze strip forms a circle with a smaller diameter than the bottom longitudinal side when it is bent together to form a circle. A gauze strip of this type, which is produced by a weaving operation and is relatively rigid, is on the one hand complex to produce and on the other hand can only be adapted to a quite specific curvature of the periphery of the end region of the upper. At points of different curvature, the problem of folding remains, however, and, at points at which the direction of curvature is opposed to that for which the conical gauze strip is designed, the problem of folding is intensified in comparison with a neutral gauze strip of a conventional type. Normally, the conical gauze strip is designed for curvatures in the region of the toes or heel of the shoe. On the inner side of the middle region of the foot, however, the shoe usually has an opposed direction of curvature. There, the conical

gauze strip exacerbates the problems instead of reducing them.

This is avoided in the case of footwear with an upper according to the invention by the use of a joining strip which is adapted or adaptable to different curvature along the periphery of the end region of the upper. Joining strip adapted to different curvature is already provided during production with a curvature that is adapted to a specific shoe model, in that it is for example punched out or injection-molded with the suitable shape of curvature. An elastically or plastically extensible strip is suitable as an adaptable joining strip, the adaptation to different curvatures being achievable by choice of a longitudinal tensile prestress during the joining to the end region of the outer material and to the material joined to the bottom longitudinal side of the joining strip or the material joined to a middle region of the joining strip.

Elastically extensible joining strip is particularly preferred, because it is adaptable to the different curvature conditions particularly simply and without being designed for a specific shoe model.

In order to obtain the desired effect, that is the avoidance of folding, the longitudinal side of the elastic joining strip that is joined to the material other than the outer material must be elastically extensible and joined to this other material under longitudinal tensile prestress at points of the bottom end of the upper with convex curvature, it being possible for the other material to be the functional layer, the lining, the bottom longitudinal side of the already mentioned second joining strip and/or an insole or some other intermediate sole. The longitudinal side of the elastic joining strip that is joined to the end of the outer material does not have to be, but may be,

elastically extensible and does not have to be, but may be, joined to the end of the outer material under longitudinal tensile prestress. If both longitudinal sides of the elastic joining strip are joined under longitudinal tensile prestress, it is recommendable, but not absolutely necessary, to join the bottom longitudinal side of the joining strip under the same longitudinal tensile prestress as the longitudinal side of the joining strip that is joined to the end of the outer material.

The fact that this elastic joining strip is joined to the material that is to be joined to it under longitudinal tensile prestress on its bottom longitudinal side and attempts to contract into its non-extended position means that the bottom longitudinal side of the elastic joining strip is shortened in comparison with the top longitudinal side, thereby preventing folding.

It is advantageous to subject the elastic joining strip to a longitudinal tensile prestress also as it is being joined to the end of the outer material. This achieves the effect that the elastic joining strip contracts under curvature on the bottom longitudinal side that is joined to the other material particularly intensively and, as a result, folding is prevented most particularly well. After joining the joining strip to the end of the outer material under longitudinal tensile prestress, it is also easier to fasten the functional layer and/or the lining and/or the other material to the joining strip under longitudinal tensile prestress, since the outer material contracts with the elastic joining strip fastened to it under longitudinal tensile prestress, and consequently the joining of the functional layer and/or of the lining material and/or of the other material to the joining strip without renewed exertion of a longitudinal tensile prestress may involve difficulties, in

particular if the outer material and the other material, for example lining material, cannot extend to the same degree in the peripheral direction of the end of the upper.

At points of the bottom end of the upper with concave curvature, a reverse procedure is recommendable, that is to join the top longitudinal side of the elastic joining strip to the end of the outer material under longitudinal tensile stress.

In one embodiment of the invention, at least one of the joins is produced by means of a sewn seam.

When the upper is being stretched onto a last, the elastic joining strip makes it possible in a very simple way for the joining strip to be pulled under the edge of the last on the sole side. On account of the longitudinal tensile prestress, the elastic joining strip flips into a position parallel to the outsole later to be applied, which may facilitate subsequent processing steps. The joining strip remains free of folds, which is important in particular in the case of shoes with a narrow radius of curvature of the peripheral contour of the sole, most particularly in the case of pointed shoes and small shoes, for example children's shoes and smaller ladies' sizes. The fact that there are no longer any folds means that, when the joining strip is formed as a gauze strip, the subsequently applied sealing material can penetrate well through the gauze strip at all points, so that a particularly high-quality and durable waterproofness of the finished footwear is obtained. Since folds no longer occur, thinner soles can be used. This has a particularly positive effect in the case of shoes on which the bottom end region of the upper including the joining strip is turned back around the bottom edge of the last and remains in this position, and the outsole does not need to have a border rising up to the upper

in order to cover a joining strip, which extends with its transverse dimension approximately perpendicularly in relation to the outsole. This is so because, since the joining strip disappears under the bottom edge of the last without any problem and free from folds, it is no longer necessary to make the border of the sole particularly high on the upper. As a result, when a water-vapor-permeable and consequently breathable functional layer and a molded-on or cemented-on outsole are used, an unnecessarily great amount of this functional layer is also not covered by non-breathable sole plastic and blocked with respect to breathability. The joining strip used according to the invention consequently contributes to the increase in the overall breathability of the footwear.

In one embodiment of the invention, a lining material is located on the inner side of the functional layer that is remote from the outer material, either as a separate layer of material or as a component part of a laminate comprising the functional layer and the lining material. In both cases, the functional layer can extend as far as the bottom border of the lining material or may end at a predetermined distance above the bottom border of the lining material.

In one embodiment of the invention, the bottom border of the functional layer and/or the bottom border of the lining material ends approximately at the height of the bottom longitudinal side of the joining strip and is joined to the latter.

In one embodiment of the invention, the bottom border of the functional layer and/or the bottom border of the lining material ends above the height of the bottom longitudinal edge of the joining strip and is not joined to the latter at all or is joined to an intermediate region of the joining strip located between the two longitudinal sides of the joining

strip. In the embodiment in which the bottom border of the functional layer and/or the bottom border of the lining material ends above the bottom longitudinal side of the joining strip, the bottom border of the functional layer and/or the bottom border of the lining material may be joined by means of a second joining strip to the bottom longitudinal side of the first joining strip and/or to an intermediate sole, for example an insole, or in the case of the sole construction without an intermediate sole or an insole, to a lashing string. The second joining strip may be constructed in a way similar to the first joining strip, in particular with regard to a different shape of curvature of the two longitudinal sides of the second joining strip, adapted to the local curvature of the periphery of the bottom end of the upper.

In the case of the process according to the invention for producing a shoe upper, which is constructed with an outer material and a waterproof functional layer arranged on the inner side of the outer material of the upper, an outer-material piece cut in the form of the upper is provided and a functional-layer piece cut in the form of the upper is provided, cut in such a way that a bottom end region of the functional-layer piece has a functional layer zone that is not covered by the outer material after the functional-layer piece has been arranged in the correct position on the inner side of the outer-material piece. The bottom border of the outer-material piece is joined over its entire periphery to a top longitudinal side of a joining strip consisting of liquefiable sealing material or of material through which liquid sealing material can flow. In this case, the joining strip is provided at points of curvature of the bottom end of the upper with an arcuate shape corresponding to the local radius of curvature, with different degrees of curvature of the two longitudinal sides of the joining strip, in such a way that, for an arc sector lying in the respective

curvature, with a predetermined unitary sector angle, the arc lengths belonging to this arc sector of the two longitudinal sides of the joining strip differ from each other all the more the greater the curvature in the arc sector respectively being considered.

In one embodiment of the invention, the functional layer zone that is not covered by the outer material of the upper is formed by an overhang of the end region of the functional layer with respect to the end region of the outer material.

In one embodiment of the invention, the joining strip is non-porous.

In a first variant of this embodiment, the non-porous joining strip or part thereof serves as sealing material, which is activated by activation, for example by means of thermal energy, high-frequency energy, infrared energy or UV energy, and thereby temporarily brought into a liquid and adhesive state, in which it develops its sealing effect. For example, the joining strip has an elastic textile strip as a backing, which is coated with a sealing compound.

In a second variant of this embodiment, in which an intermediate sole or outsole is molded onto the footwear, a material which can be melted by the sole material which is hot-liquid during the molding-on of the sole is used for the joining strip. Since the part of the footwear on the sole side is in this case kept in shape by the molded-on sole, the stability of the footwear is still ensured even if the joining strip is completely melted away during the molding-on of the sole.

A polyurethane strip is suitable for example for the non-porous joining strip.

In another embodiment of the invention, the joining strip is porous or permeable and preferably has the form of a gauze strip, with such porosity or permeability that it can be penetrated by liquid sealing material. The liquid sealing material is either sole material that is liquid during the molding-on of a sole or, in particular if the footwear is provided with a cemented-on outsole, a sealing adhesive that leads to waterproofness in the cured state, preferably in the form of reactive hot-melt adhesive that leads to waterproofness in the fully reacted state. In this case, the sealing adhesive is substantially applied only to the porous joining strip and seals the functional layer in that region of the functional layer zone which is opposite the porous joining strip.

It is important that the joining strip is elastic at least on its bottom longitudinal side, while the other longitudinal side of the joining strip may be at least extensible or likewise elastic.

In one embodiment of the invention, the porous or permeable elastic gauze strip has the form of a ladder, two longitudinal webs forming the two longitudinal sides of the gauze strip being joined by transverse webs uniformly spaced apart from one another in the longitudinal direction of the gauze strip. In this case, at least one of the longitudinal webs is elastic, while the transverse webs are preferably rigid or non-elastic. In one embodiment of the gauze strip, the longitudinal webs consist of unvulcanized rubber, vulcanized rubber, latex or an elastomer, for example Elastan, while the transverse webs preferably consist of polyamide, polyester or a similar non-elastic material.

With regard to an elastic gauze strip formed in such a way, there are several variants which are suitable for the purpose according to the invention, for example:

- both longitudinal webs are plastically deformable by 100% in such a way that folding does not occur at the points of curvature of the bottom end of the upper;
- both longitudinal webs are elastically deformable by 100% in such a way that folding does not occur at the points of curvature of the bottom end of the upper;
- both longitudinal webs are each partially elastically and plastically deformable in such a way that folding does not occur at the points of curvature of the bottom end of the upper;
- one of the two longitudinal webs is partially elastically and plastically deformable and the other longitudinal web is plastically deformable by 100% in such a way that folding does not occur at the points of curvature of the bottom end of the upper;
- one of the two longitudinal webs is partially elastically and plastically deformable and the other longitudinal web is elastically deformable by 100% in such a way that folding does not occur at the points of curvature of the bottom end of the upper.

In an embodiment of the invention using an elastic gauze strip, the gauze strip is produced by a weaving operation, the longitudinal webs being formed by longitudinal or warp threads which are woven with transverse or weft threads. Longitudinal threads are provided only in the region of the longitudinal webs. In the central region between the longitudinal webs, remaining free of longitudinal threads, the transverse threads form the transverse webs. In this case, the transverse webs are arranged at such a spacing from one another that the gauze strip is given adequate permeability for sealing material. To obtain the elasticity, elastic threads forming longitudinal threads are kept under tensile stress during the weaving operation, at least if they belong to one of

the two longitudinal webs. The elastic gauze strip can be variously formed, according to specific requirements. There are possibilities for only one of the longitudinal webs to be elastic, for both longitudinal webs to be elastic, for the two longitudinal webs to have different elasticity and also for the gauze strip to have zones of different elasticity along its length, in order for example to provide a greater elasticity in the region of the toes and heel of the footwear and a lesser elasticity in the side foot regions of the footwear.

The possibility of using a gauze strip with constant elasticity over its length for the entire periphery of the shoe upper is preferred, it being possible for the gauze strip to be sewn to the outer material under a greater longitudinal tensile prestress at the points of smaller radius of curvature, that is in the region of the toes and heel, than in the region of the longitudinal sides of the foot.

The solution according to the invention is suitable both for a footwear construction with an insole and for a footwear construction without an insole.

In the case of a footwear construction without an insole, the end region of the upper on the sole side is lashed together by a lashing string (also known by the term string lasting). In the case of a footwear construction with an insole, the upper material is joined to the insole either by sealing by a Strobel seam, i.e. by means of a Strobel seam joining the upper material and the insole, or by cemented-lasting of a lasting allowance belonging to the bottom end region of the upper onto the underside of the insole by means of lasting cement. The use of both fastening methods in combination on one and the same footwear is also possible, with for example the end region of the functional layer being joined to the insole by means of

a Strobel seam and the end region of the outer material being joined to the insole by means of cement-lasting. There is also footwear with a part-insole, which only extends over part of the length of the footwear, the bottom end of the upper being lashed together by means of a lashing string over the part of the length of the shoe that has no insole and cement-lasted over the part of the length of the shoe that has the part-insole. In a corresponding way, the elastic joining strip is joined to the peripheral border of the insole by means of the Strobel seam or the longitudinal side of the joining strip that is not joined to the outer material of the upper is fastened to the border of the lasting allowance.

The use of an elastic joining strip has the effect that, after the joining of one longitudinal side of the joining strip to the outer material of the upper under longitudinal tensile prestress, the part of the joining strip that is not joined to the outer material of the upper flips inward in such a way that this part of the joining strip extends away approximately perpendicularly from the inner side of the end region of the upper on the sole side and extends approximately parallel to the outsole still to be attached. This is advantageous to the extent that the lateral border of the molded-on or cemented-on outsole does not need to be as high as in the case where the joining strip remains perpendicular to the outsole and/or has folds.

Suitable in particular for sole constructions which have neither a waterproof insole nor a waterproof intermediate sole nor a waterproof outsole is an embodiment of the invention in which there is provided a sheet-like waterproof sealing layer which is applied to the underside of a turned-back end region of the upper such that it extends parallel to the still to be applied outsole in such a way that a bottom opening of the upper is sealed as far as the sealing material

zone. The sealing layer is preferably a sealing sheet (also known to those skilled in the art as a gasket), which is cemented onto the underside of the insole or, if it is an insole-free construction with a lashing string, onto the underside of the turned-back, lashed-together end region of the upper. In one embodiment, the sealing sheet is waterproof and preferably also water-vapor-permeable. It may be constructed with a laminate which has a backing material layer and a waterproof, preferably also water-vapor-permeable functional layer.

Depending on the specific construction of the sole, the sealing layer may also be an intermediate sole or an outsole or else a layer of sealing material, for example in the form of a sealing adhesive applied to the inner side of the outsole or sealing adhesive applied only to the joining strip formed as a gauze strip, in particular in the form of reactive hot-melt adhesive.

For sealing the functional layer by means of the joining strip (if the latter has sealing material itself) or through the sealing strip (if the latter is formed as a porous or permeable gauze strip), any material leading to waterproofness is suitable. In the case of the use of adhesive having sealing properties as the sealing material, preference is given to reactive hot-melt adhesive, which brings about particularly good sealing in the region of the sole construction of the footwear. Reactive hot-melt adhesive has, on the one hand, particularly great creepability in the liquid state before fully reacting and, on the other hand, brings about particularly great and durable waterproofness in the fully reacted state. The reactive hot-melt adhesive can be applied with very simple means, for example be brushed on, sprayed on or applied in the form of a strip of adhesive or a bead of adhesive, the reactive hot-melt adhesive being made

tacky by heating and, as a result, allowing itself to be fixed in the region of the joining strip before the full reacting process and accompanying durable adhesive bonding to the functional layer begins.

The adhesive bonding of the reactive hot-melt adhesive or other sealing material to the functional layer is particularly intimate if the reactive hot-melt adhesive or the other sealing material is mechanically pressed against the functional layer after being applied to the joining strip. Preferably suitable for this purpose is a pressing device, for example in the form of a pressing pad, with a smooth material surface which cannot be wetted by the reactive hot-melt adhesive or other sealing material and therefore cannot bond with the reactive hot-melt adhesive or the other sealing material, for example of non-porous polytetrafluoroethylene (also known by the trade name Teflon), silicone or PE (polyethylene). Preferably used for this purpose is a pressing pad, for example in the form of a rubber pad or air cushion, the pressing surface of which is covered with a film of one of the said materials, for example non-porous polytetrafluoroethylene, or such a film is arranged between the sole construction provided with the reactive hot-melt adhesive or the other sealing material and the pressing pad before the pressing operation.

Preferably, a reactive hot-melt adhesive which can be cured by means of moisture is used, which adhesive is applied to the region to be adhesively bonded and exposed to moisture to make it fully react. In one embodiment of the invention, a reactive hot-melt adhesive which can be thermally activated and can be cured by means of moisture is used, which adhesive is thermally activated, applied to the region to be adhesively bonded and exposed to moisture to make it fully react.

Reactive hot-melt adhesives refer to adhesives which, before their activation, comprise relatively short molecular chains with an average molecular weight in the range from approximately 3000 to approximately 5000 g/mol, are non-adhesive and, possibly after thermal activation, are brought into a state of reaction in which the relatively short molecular chains are crosslinked to form long molecular chains and thereby cure, doing so predominantly in moist atmosphere. During the reaction or curing time, they are capable of adhesive bonding. After the crosslinking curing, they cannot be re-activated. When they fully react, three-dimensional crosslinking of molecular chains can occur. The three-dimensional crosslinking leads to particularly great protection against water ingress into the adhesive.

Suitable for example for the purpose according to the invention are polyurethane reactive hot-melt adhesives, resins, aromatic hydrocarbon resins, aliphatic hydrocarbon resins and condensation resins, for example in the form of epoxy resin.

Particularly preferred are polyurethane reactive hot-melt adhesives, referred to hereafter as PU reactive hot-melt adhesives.

In one practical embodiment of footwear according to the invention, a PU reactive hot-melt adhesive which is obtainable under the name IPATHERM S 14/242 from the company H. P. Fuller of Wells, Austria, is used. In another embodiment of the invention, a PU reactive hot-melt adhesive which is obtainable under the name Macroplast QR 6202 from the company Henkel AG, Dusseldorf, Germany, is used.

A functional layer which is not only water-impermeable but also water-vapor-permeable is particularly

preferred. This makes it possible to produce waterproof shoes which remain breathable in spite of being waterproof.

In one embodiment of the invention, the functional layer of the lining material of the upper and/or the sealing sheet has a layer of expanded microporous polytetrafluoroethylene (ePTFE).

A functional layer is regarded as "waterproof", if appropriate including seams provided at the functional layer, if it ensures a water ingress pressure of at least 1×10^4 Pa. The material of the functional layer preferably ensures a water ingress pressure of over 1×10^5 Pa. The water ingress pressure must be measured here by a test method in which distilled water at 20 ± 2°C is applied with increasing pressure to a sample of the functional layer of 100 cm^2. The pressure increase of the water is 60 ± 3 cm of water column per minute. The water ingress pressure then corresponds to the pressure at which water appears for the first time on the other side of the sample. Details of the procedure are prescribed in ISO Standard 0811 from the year 1981.

A functional layer is regarded as "water-vapor-permeable" if it has a water-vapor permeability coefficient Ret of less than 150 $m^2 \times Pa \times W^{-1}$. The water-vapor permeability is tested by the Hohenstein skin model. This test method is described in DIN EN 31092 (02/94) or ISO 11092 (1993).

Whether a shoe is waterproof can be tested for example by a centrifuge arrangement of the type described in US-A-5 329 807.

Suitable materials for the waterproof, water-vapor-permeable functional layer are, in particular, polyurethane, polypropylene and polyester, including

polyether esters and their laminates, as described in the publications US-A-4,725,418 and US-A-4,493,870. Particularly preferred, however, is expanded microporous polytetrafluoroethylene (ePTFE), as described for example in the publications US-A-3,953,566 and US-A-4,187,390, and expanded polytetrafluoroethylene which is provided with hydrophilic impregnating agents and/or hydrophilic layers; see for example the publication US-A-4,194,041. A microporous functional layer is understood to mean a functional layer of which the average pore size lies between approximately 0.2 µm and approximately 0.3 µm.

The pore size can be measured with the Coulter Porometer (trade name), which is produced by Coulter Electronics, Inc., Hialeath, Florida, USA.

If ePTFE is used as the functional layer, the reactive hot-melt adhesive can penetrate into the pores of this functional layer during the cementing operation, which leads to a mechanical anchoring of the reactive hot-melt adhesive in this functional layer. The functional layer consisting of ePTFE may be provided with a thin polyurethane layer on the side with which it comes into contact with the reactive hot-melt adhesive during the cementing operation. If PU reactive hot-melt adhesive is used in conjunction with such a functional layer, there occurs not only the mechanical bond but also a chemical bond between the PU reactive hot-melt adhesive and the PU layer on the functional layer. This leads to a particularly intimate adhesive bonding between the functional layer and the reactive hot-melt adhesive, so that particularly durable waterproofness is ensured.

Leather or textile fabrics are suitable for example as the outer material of the upper. The textile fabrics may be, for example, woven or knitted fabrics, nonwovens or felt. These textile fabrics may be produced from natural fibers, for example from cotton

or viscose, from synthetic fibers, for example from polyesters, polyamides, polypropylenes or polyolefins, or from blends of at least two such materials.

When a functional layer is used, a lining material is normally arranged on the inner side. The same materials as are specified above for the outer material of the upper are suitable as lining material, which is often combined with the functional layer to form a functional-layer laminate. The functional-layer laminate may also have more than two layers, it being possible for a textile backing to be located on the side of the functional layer remote from the lining layer.

The outsole of footwear according to the invention may consist of waterproof material, such as for example rubber or plastic, for example polyurethane, or of non-waterproof, but breathable material, such as in particular leather, leather provided with rubber or plastic intarsias or rubber or plastic provided with leather intarsias. In the case of non-waterproof outsole material, the outsole can be made waterproof, while maintaining breathability, by being provided with a waterproof, water-vapor-permeable functional layer at least at points at which the sole construction has not already been made waterproof by other measures.

The insole of footwear according to the invention may consist of viscose, a nonwoven, for example polyester nonwoven, to which fusible fibers may be added, leather or adhesively bonded leather fibers. An insole is obtainable under the name Texon Brandsohle from Texon Mockmuhl GmbH of Mockmuhl, Germany. Insoles of such materials are water-permeable. An insole of such material or other material can be made waterproof by arranging a layer of waterproof material on one of its surfaces or inside it. For this purpose, for example, a film with Kappenstoff V25 from the company Rhenoflex

of Ludwigshafen, Germany, may be ironed on. If the insole is to be not only waterproof but also water-vapor-permeable, it is provided with a waterproof, water-vapor-permeable functional layer, which is preferably constructed with ePTFE (expanded, microporous polytetrafluoroethylene). Suitable for this for example is a laminate which contains a waterproof, water-vapor-permeable functional layer and is obtainable under the trade name TOP DRY from W. L. Gore & Associates GmbH, Putzbrunn, Germany.

A further possibility is to adhesively attach such a laminate (TOP DRY) from beneath onto the insole and at least onto the lasted overhang of the lining, whereby the upper is made waterproof already before an outsole is cemented on.

The invention is now explained in more detail on the basis of embodiments.

The drawings show several embodiments of footwear according to the invention in different stages of production.

Figure 1 shows in an oblique view a plan view of the underside of a shoe upper according to the invention of a first embodiment with a gauze strip;

Figure 2 shows an oblique view of an embodiment of an elastic gauze strip used in Figure 1;

Figure 3 shows a shoe of the style according to the invention with an insole sealed on by a Strobel seam;

Figure 4 shows a partial sectional view of the construction according to Figure 3;

Figure 5 shows an embodiment of a cement-lasted shoe with an insole;

Figure 6 shows a partial sectional view of the construction according to Figure 5;

Figure 7 shows a shoe without an insole with a lashing string (string lasting);

Figure 8 shows a partial sectional view of the construction shown in Figure 7;

Figure 9 shows an embodiment of an elastic gauze strip which can be used in Figure 7, with an integrated string-lasting tunnel and lashing string;

Figure 10 shows an embodiment of a shoe according to the invention with a molded-on sole;

Figure 11 shows a partial sectional view of this embodiment;

Figure 12 shows a partial sectional view of a construction with sealing by means of a molded-on sole;

Figure 13 shows a diagram to explain some of the terms used in the present document;

Figure 14 shows in representations A to D various embodiments of bottom ends of uppers designed according to the invention;

Figure 15 shows in representations A to D the various embodiments of the bottom ends of uppers according to the embodiments A to D of Figure 14 with joining strips extending perpendicularly in relation to an insole; and

Figure 16 shows in representations A to D the various embodiments of the bottom ends of uppers according to the embodiments A to D of Figure 14 with joining strips extending parallel to an insole.

In the text which follows, terms such as top and bottom refer to footwear that is in the normal position, that is with the outsole facing downward, even if the drawings show shoes in the inverted position.

Figure 1 shows an upper 11 with an outer material 13 of the upper, a lining material 15 of the upper and an elastic gauze strip 17, by means of which an end region or end 19 of the outer material and an end region 21 of the lining material are joined to each other. The lining material 15 of the upper comprises a functional layer 16 (Figure 16) and a lining layer 18, which may be individual layers or layers of a laminate. In embodiments of a first type, the functional layer 16 and the lining layer 18 have the same extents. In embodiments of a second type, the functional layer 16 is shorter than the functional layer 18 at the bottom end of the upper.

The gauze strip 17, represented enlarged in Figure 2, comprises a first or top longitudinal web 23 and a second or bottom longitudinal web 25, which are joined to each other by means of transverse webs 27. As can be seen in Figure 1, the first longitudinal web 23 is joined to the end region 19 of the outer material by means of a first seam 29 and joined to the end region 21 of the lining material by means of a second seam 31.

At least the second longitudinal web 25 consists of elastic material and is sewn to the end region 21 of the lining material under longitudinal tensile prestress. The first longitudinal web 23 may, but does

not have to, be elastic. The transverse webs 27 may be elastic, but are preferably non-elastic.

In one embodiment of the elastic gauze strip 17, the two longitudinal webs 23 and 25 consist of latex rubber or some other (rubber-like) material with elastic behavior (for example Lycra, etc.) and the transverse webs 27 consist of polyamide, polyester or a similar material. The length of the transverse webs 27 and their spacing from one another are chosen such that the waterproof, water-vapor-permeable functional layer that is present in the lining material 15 of the upper can be wetted adequately by sealing material through the gauze strip 17.

An embodiment of a currently preferred elastic gauze strip has a width of approximately 10 mm, of which the two longitudinal webs 23 and 25 each take up approximately 3.5 mm and the clearance, that is the length of the free transverse webs 27, takes up approximately 3 mm. In this case, the transverse webs 27 have a spacing from one another of approximately 0.25 mm. In general, the choice of the spacing of the transverse webs from one another is to be based on the specific application, account having to be taken in particular of the viscosity of the sealing material for which the gauze strip is intended to be penetrable.

In another embodiment for ski boots, the gauze strip 17 has a width of approximately 15 mm.

In an embodiment of the gauze strip with the above dimensions, it is a woven, elastic strip with warp or longitudinal threads of natural rubber and textured polyamide threads, a material composition of 40% natural rubber, 40% monofilament polyamide and 20% textured polyamide being preferred.

Such a gauze strip is preferably produced by a weaving operation. In this case, warp or longitudinal threads are located only in the region of the two longitudinal webs 23 and 25, so that the transverse or weft threads lie free in the region between the two longitudinal webs 23 and 25 and can consequently form the transverse webs 27. Elastic longitudinal threads, preferably made of rubber, and non-elastic longitudinal threads, preferably made of polyamide, are used as longitudinal threads for the longitudinal webs 23 and 25, only non-elastic threads, preferably likewise made of polyamide, are used for the transverse webs. During the operation of weaving the elastic gauze strip 17, the elastic longitudinal threads are stretched by a predetermined degree and the non-elastic longitudinal threads are arranged parallel to the stretched elastic longitudinal threads. In this state, the longitudinal threads are woven with the transverse threads. After the weaving operation, the elastic longitudinal threads contract and the gauze strip 17 relaxes correspondingly.

In the production of this gauze strip, different elasticity values can be produced for the two longitudinal webs 23 and 25, either by using differently extensible strips for the two longitudinal webs 23 and 25 or by stretching the two longitudinal webs 23 and 25 to different extents during the operation of weaving them with the transverse webs 27.

During the sewing of the gauze strip 17 to the upper 11, firstly the first longitudinal web 23 is sewn to the end 19 of the outer material, to be precise under longitudinal tensile prestress of the first longitudinal web 23. After securely sewing the first longitudinal web 23 to the end region 19 of the outer material, the remaining part of the gauze strip with the second longitudinal web 25 and the transverse webs 27 flips inward, as shown in Figure 1 in the heel region of the upper. This flipping over is a

consequence of the sewing of the first longitudinal web 23 to the end region 19 of the outer material under longitudinal tensile prestress. The flipping over has the effect that the gauze strip 17 assumes a position in which it extends substantially parallel to the outsole to be applied later. This flipping over also takes place in the toe region of the upper 11, which in most cases will then lead to the flipping over of the gauze strip 17 over its entire length. In Figure 1, the flipping over of the gauze strip 17 is shown only in the heel region of the upper 11, in order to allow the joining of the lining material 15 of the upper to the gauze strip 17 in the front foot region to be represented better.

The following figures show various embodiments of footwear according to the invention in a later stage of production than Figure 1, to be precise each in a perspective plan view of the underside, partly in sectional view, and a part-cross-sectional view. The embodiments represented in Figures 3-11 and 14 to 16 differ from one another with regard to the sealing material and/or the sole construction.

Figures 3 and 4 show an embodiment of footwear according to the invention which has an insole sealed by a Strobel seam and an adhesively attached outsole.

On the basis of the upper 11 shown in Figure 1, with a gauze strip 17, in the embodiment shown in Figures 3 and 4, an insole 33 is joined to the second longitudinal web 25 of the elastic gauze strip 17 by means of a Strobel seam 35. In this case, the gauze strip 17 extends in the plane of the insole 33.

In a width which corresponds approximately to the width of the gauze strip 17, there is applied to the gauze strip 17 a sealing material in the form for example of sealing adhesive 37, which forms a closed sealing

material zone which runs around in the peripheral direction of the end region of the upper and in which the sealing adhesive 37, penetrating through the gauze strip 17, forces its way as far as the functional layer of the lining material 15 of the upper, and seals it in a waterproof manner.

For the case in which neither the insole 33 nor an intermediate sole or outsole 41 still to be applied is waterproof, the underside of the insole facing the outsole 41 is covered by a sealing sheet 39 (a gasket), which has a waterproof functional layer, which is preferably likewise water-vapor-permeable, in order to maintain breathability also in the sole region of the shoe in spite of waterproofness. The sealing sheet 39 need not - as represented in Figure 3 - extend as far as the outer border of the gauze strip 17. It is sufficient for it to extend by an amount which covers the insole 33 and the Strobel seam 35, the sealing sheet 39 overlapping with the sealing adhesive 37 in order to achieve secure sealing of the sole construction.

On account of its great creepability in the liquid, non-reacted state and its great and durable waterproofness in the fully reacted state, reactive hot-melt adhesive, in particular polyurethane reactive hot-melt adhesive, is preferably used as the sealing adhesive 37. On account of its great creepability in the liquid, non-reacted state, the reactive hot-melt adhesive has the ability to a particularly high degree to penetrate the elastic gauze strip 17, to force its way as far as the functional layer of the lining material 15 of the upper and wet the latter, the reactive hot-melt adhesive getting under the transverse webs of the gauze strip 17 and consequently making it possible for the functional layer to be wetted with the reactive hot-melt adhesive over its full surface area, and consequently has the ability to prevent water which

has forced its way via the outer material 13 of the upper as far as the gauze strip 17 from getting inside the lining material 15 of the upper and consequently inside the shoe.

In the embodiment shown in Figures 5 and 6, the turned-back part of the end region of the upper on the sole side is fastened to the insole 33 by cement-lasting. The cement-lasting takes place by means of a lasting cement 45, which can be seen in the cross-sectional view in Figure 6.

Also in this embodiment, on the bottom side of the gauze strip 17 (facing the outsole 41) there is a sealing adhesive 37, preferably in the form of reactive hot-melt adhesive, as already explained in connection with the embodiment of Figures 3 and 4.

Also in this embodiment, a sealing sheet 39 or a continuous layer of reactive hot-melt adhesive applied over the surface area may be provided for the case where the outsole 41 is not waterproof.

Figures 7-9 show an embodiment of a shoe without an insole, in which the end region of the upper on the sole side extending parallel to the outsole 41 is tensioned or lashed together by means of a lashing string 49. The lashing string 49 is guided in a string-lasting tunnel 47, which is for example attached to the second longitudinal web 25 of the elastic gauze strip 17 in the way shown in Figure 9. As Figure 7 shows, the string-lasting tunnel 47 is open at two points of the periphery of the shoe which are located between the heel region and the toe region, in order to allow the lashing string 49 to be gripped, tensioned and knotted here.

Also in this embodiment, sealing adhesive 37, preferably again in the form of reactive hot-melt

adhesive, is applied to the gauze strip 17, it being possible to refer to the explanations in connection with Figure 3 with regard to details.

While Figure 9 shows an embodiment in which the string-lasting tunnel 47 is attached directly to the gauze strip 17, Figure 8 shows an embodiment in which an initially separate string-lasting tunnel 47 with a lashing string 49 located in it is securely sewn by means of the second seam 31 between the second longitudinal web 25 of the gauze strip 17 and the end region 21 of the lining material.

The shoe construction corresponding to Figures 7 to 9 may be modified by molding onto the underside of the end region of the upper a sole made of waterproof material, which may be an intermediate sole or an outsole, by means of which sealing of the sole structure is brought about. In this case, neither a gasket nor a layer of sealing material or reactive hot-melt adhesive layer is required.

Figures 10 and 11 show an embodiment in which the sealing material is formed by sole material of a sole, which may be for example an intermediate sole or the outsole 41. In this embodiment, all the production steps up to the fastening of the insole to the gauze strip 17 by means of a Strobel seam 35 proceed in the way shown in Figures 3 and 4 and explained there or by means of a lashing string as explained in connection with Figures 7 to 9. As a departure from the embodiment in Figures 3 and 4, in the embodiment according to Figures 10 and 11 no sealing adhesive 37 and no gasket is applied. In the embodiment according to Figures 10 and 11, the shoe has a molded-on sole 41. The sole material, which is liquid when the sole 41 is molded on, penetrates through the gauze strip 17, wets the functional layer of the lining material 15 of the upper in the region of the gauze strip 17 and brings

about sealing of the functional layer in this region. The sealing function which in the embodiments of Figures 3 and 7 is undertaken by separately applied sealing adhesive 37 is performed in the embodiment according to Figure 10 by the sole adhesive.

A sealing sheet 39, as shown in the previous embodiments, is not required in the embodiment according to Figure 10, because the molded-on outsole 41 seals the entire region of the sole structure.

While the embodiment according to Figure 10 is suitable only for shoes with a molded-on sole, the embodiments according to Figures 5 and 7 can be used for soles which are not molded on, that is to say for soles which are adhesively attached, which may be plastic soles and consequently waterproof soles, so that the sealing sheet 39 is not required, or water-permeable soles, for example made of leather, in which case the sealing sheet 39 is recommendable to make the sole construction waterproof, the sealing sheet preferably being not only waterproof but also water-vapor-permeable.

Figure 12 shows a partial sectional view of a cement-lasted shoe construction with a molded-on sole 41, which may be an intermediate sole or an outsole. During the molding on of the sole 41, liquid sole material penetrates through the gauze strip 17, forces its way as far as the functional layer of the lining material 15 and seals the functional layer. A gasket or a layer of sealing material is therefore not required. Otherwise, the construction in Figure 12 coincides with the construction shown in Figure 6.

On the basis of Figure 13, the terms used above, arc sector, arc lengths and unitary sector angle, are now also explained. Figure 13 shows two elliptical arcs, to be precise an outer elliptical arc and an inner elliptical arc, which are intended respectively to

represent the longitudinal side of the joining strip that is joined to the end region of the outer material and the longitudinal side of the joining strip that is joined to the end region of the lining material. At a point of strong elliptical curvature and at a point of weak elliptical curvature, an arc sector S1 and an arc sector S2 are respectively formed by means of the two lines of an angle. Both arc sectors S1 and S2 have the same angle w, which is referred to here as the unitary sector angle. The lines of the angle of the arc sector S1 bound an outer arc length BO1 of the outer ellipse and an inner arc length BF1 of the inner ellipse. In this case, BO represents the arc length of the outer material and BF represents the arc length of the lining material. The lines of the angle of the arc sector S2 bound an outer arc length BO2 of the outer ellipse and an inner arc length BF2 of the inner ellipse. The arc lengths BO1 and BO2 are duplicated and offset as thick lines close to the arc length BF1 and BF2, respectively, in order to make clear the differences in length between BO1 and BF1 on the one hand and between BO2 and BF2 on the other hand. It can be seen on the one hand that there are differences in length between the outer arc lengths and the inner arc lengths of the respective sector and on the other hand that this difference in length is much greater at the point of stronger elliptical curvature than at the point of weaker elliptical curvature.

When using a conventional gauze strip, which cannot compensate for these differences in length, folding is caused. When using a joining strip according to the invention, by means of which such differences in length can be compensated, folding is avoided. The fact that the differences between outer and inner arc lengths are different at points with different degrees of elliptical curvature shows on the one hand that the conical joining strip conventionally used cannot avoid folding and shows on the other hand that an elastic

gauze strip with which an arc length compensation can be produced unproblematically and simply, even in the case of differences of differing magnitude between the outer arc length and the inner arc length, is to be particularly preferred.

In the case of use of an elastic joining strip, it should have a minimum elasticity, that is to say minimum extensibility before reaching plastic deformation, in order to achieve the adaptation to the different arc lengths at the peripheral borders of the end region of the outer material and the end region of the lining material, and consequently at the two longitudinal sides of the elastic joining strip, even at points of strong curvature of the periphery of the end region of the upper. The elastic extensibility should be so great that the elastic joining strip can be sewn onto the outer material of the upper with adequate longitudinal tensile prestress to prevent folding in the joining strip and in the material sewn to it on the other side than the end of the outer material. The elastic restoring force of the elastic joining strip should be adequate to provide the joining strip with the prestressing force required for arc length compensation. General values or limits for the elasticity, the longitudinal tensile prestress and the elastic restoring force cannot be given, since they depend on the specific form of shoe and the associated maximum curvatures of the periphery of the end region of the upper. However, it should be an easy matter for a person skilled in the relevant art to determine and select the elasticity parameters of the joining strip that are suitable for a specific shoe.

Suitable in particular as elastic material for the elastic longitudinal web or the elastic longitudinal webs of the elastic joining strip are unvulcanized rubber, vulcanized rubber, elastic plastics, such as synthetic rubber, PVC, silicone, PU for example, and

textile materials in which rubber filaments and/or filaments of such materials are incorporated.

The elastic joining strip has an extensibility of at least approximately 20%. The joining strip preferably has an extensibility of at least approximately 30%, with particular preference of at least approximately 40% and most particular preference of at least approximately 50%. These extensibility values have in this case an elastic elongation component of at least 40%. The elastic elongation component is preferably 100%. In particular, at least the longitudinal web of the elastic joining strip that is not to be joined to the end of the outer material, for example to the end region of the lining material, has an elastic extensibility that is as high as possible, in order to achieve the desired freedom from folds at the points of the bottom periphery of the end region of the upper having a strong curvature.

In a practical example of an elastic gauze strip used for the invention, with the dimensions already mentioned (gauze strip width 10 mm, longitudinal web widths each approximately 3.5 mm, transverse web length approximately 3 mm, transverse web spacings approximately 0.25 mm) and the already mentioned materials (longitudinal webs: woven, elastic strip with warp or longitudinal threads made of natural rubber and textured polyamide threads with a material composition of 40% natural rubber, 40% monofilament polyamide and 20% textured polyamide; transverse webs: polyester), the following rounded average values have been obtained from the measurements of several samples:

- elongation of 66% under a stretching force of 50 N
- elongation of 85% under a stretching force of 100 N
- elongation of 100% under a stretching force of 150 N
- elongation at break of 124% under a stretching force of 206 N

In comparison with this, a gauze strip as used in conventional footwear and having a width of likewise 10 mm has the following values, likewise averaged from three samples:

- elongation of 4% under a stretching force of 50 N
- elongation of 10% under a stretching force of 100 N
- elongation of 15% under a stretching force of 150 N
- elongation at break of 30% under a stretching force of 360 N

Values for the elasticity and restoring force are determined by tensile test measurements on the basis of European Standard EN ISO 13934-1 of April 1999 using an Instron test device (where Instron is the name of a manufacturer).

With regard to elongation and elasticity, the following definitions devised for the textile sector have been adopted for the present application.

Elongation:
Tensile loading of a material causes an elongation - with respect to its original length. A distinction is drawn between elongation at break, elastic elongation and permanent elongation. In the case of elongation at break, the lengthening at the time of breakage is determined. Under loading below the breaking limit, an elongation that is reversed when the material is relieved of loading takes place (elastic elongation), by contrast with irreversible permanent elongation, which leads to a change in shape of the material.

Elasticity:
Ability of a material to reverse the change in shape caused by the action of a force (bending, pressure, tension, etc.) when the effect of the force subsides.

On the basis of Figures 14 to 16, various embodiments of bottom ends of uppers designed according to the invention and how they are joined together with intermediate soles, for example insoles, in different configurations are also considered in a very schematized form of representation.

Four different types of design of bottom ends of uppers are shown in the representations A to D of Figure 14.

Of these, representation A shows the type of design already shown in embodiments of Figures 1 to 12 and already explained on the basis of these figures, in which the bottom end 13 of the outer material is lengthened downward by means of the joining strip 17, the bottom end 13 of the outer material is joined to the first or top longitudinal web 23 of the joining strip 17 by means of a first or top seam 29 and the bottom end of the lining material 15 of the upper reaches down as far as the second or bottom longitudinal web 25 and is joined to the latter by means of the second or bottom seam 31. In this case, the lining material 15 of the upper has a functional layer 16 and a lining layer 18. The functional layer has in the region adjacent to the joining strip 17 a functional layer zone 20, in which the functional layer 16 can be sealed in a waterproof manner by means of the joining strip 17 itself, if it consists of activatable sealing material, or through the joining strip 17, if it consists of material through which liquid sealing material can flow.

The representation B of Figure 14 shows a type of design in which the lining material 15 of the upper, having the functional layer 16 and the lining layer 18, ends above the bottom longitudinal web 31 of the joining strip 17, to be precise in a region of the joining strip 17 located between the two longitudinal webs 23 and 25. In this case, the lining material 15

of the upper is fastened by means of a seam 32 in a central region of the joining strip 17 located between the two longitudinal webs 23 and 25. In this design, liquid sealing material which flows through the joining strip not only flows to the functional layer zone 20 but in the region underneath the border of the functional layer can also force its way inside footwear provided with a construction of the upper of this type.

The representation C of Figure 14 shows a type of design in which the lining material 15 of the upper, having the functional layer 16 and the lining layer 18, likewise ends above the bottom longitudinal web 31 of the joining strip 17, but the bottom end of the lining material 15 of the upper is lengthened by means of a second joining strip 34 down to the height of the bottom longitudinal web 25 of the first joining strip 17. In this case, a top longitudinal web 36 of the second joining strip 34 is fastened to the bottom end of the lining material 15 of the upper by means of the seam 32 and a bottom longitudinal web 38 of the second joining strip 34 is fastened to the bottom longitudinal web 25 of the first joining strip 17 by means of the seam 31. The bottom longitudinal web 38 of the second joining strip 34 could, however, also be fastened to another element of the construction of the upper or of the shoe by a separate seam.

The representation D of Figure 14 shows a type of design in which, although the lining layer 18 reaches down as far as the bottom longitudinal web 25 of the first joining strip 17 and is joined to the bottom longitudinal web 25 of the first joining strip 17 by means of the bottom seam 31, the functional layer 16 stops above the bottom end of the lining layer 18. If a material through which liquid sealing material can flow is used for the lining layer 18, it is possible in the case of this type of design, in just the same way as in the case of the type of design B, for liquid

sealing material not only to flow to the functional layer zone 20 but also to force its way to the inner region of the footwear provided with a construction of the upper of this type. The type of design D can also be modified by lengthening its bottom end of the functional layer by means of a second joining strip in the same way as in the case of the type of design C. In the case of the type of design D, however, the bottom end of the lining layer 18 could also be fastened to another element of the construction of the upper or of the shoe by a separate seam.

Figure 15 shows in representations A to D the various designs A to D of the upper of Figure 14 each with an intermediate sole, for example an insole 33, to be precise with joining strips 17, and if appropriate 34, extending perpendicularly in relation to the insole 33. In this case, the join to the insole 33 is produced in the exemplary embodiments represented by means of a Strobel seam 35.

Figure 16 shows in representations A to D the various designs A to D of the upper of Figure 14 each with an intermediate sole, for example an insole 33, to be precise with joining strips 17, and if appropriate 34, extending parallel to the insole 33. In this case, the join to the insole 33 is produced in the exemplary embodiments represented by means of a Strobel seam 35, but could also be produced by a cement-lasting connection between the bottom end of the construction of the upper and the insole 33. As a departure from the designs A to D of Figure 16, the bottom end of the respective construction of the upper may also be joined to a string-lasting channel instead of to an insole or other type of intermediate sole, for example in the case of footwear which does not have an intermediate sole or an insole at all or in part of its length.

Patent claims

1. A shoe upper having:
a bottom end of the upper,
an outer material with a bottom end (19) of the outer material;
a waterproof functional layer (16), which has a bottom end region of the functional layer with a functional layer zone (20) not covered by outer material;
a joining strip (17), which runs in the peripheral direction of the upper, has a top longitudinal side (23) of the joining strip, joined to the end (19) of the outer material, and a bottom longitudinal side (25) of the joining strip, at least partially overlaps the functional layer zone (20) and consists of liquefiable sealing material or of material through which liquid sealing material (37; 41) can flow;
the joining strip (17) having at points of curvature of the bottom end (19) of the outer material an arcuate shape corresponding to the local radius of curvature, with different degrees of curvature of the two longitudinal sides (23, 25) of the joining strip, in such a way that, for an arc sector lying in the respective curvature, with a predetermined unitary sector angle, the arc lengths belonging to this arc sector of the two longitudinal sides (23) of the joining strip differ from each other all the more the greater the curvature in the arc sector respectively being considered.

2. The shoe upper as claimed in claim 1, in which the bottom longitudinal side (25) of the joining strip is joined to the functional layer (16).

3. The shoe upper as claimed in claim 1, in which a region of the joining strip (17) located between

the two longitudinal sides (23, 25) of the joining strip is joined to the functional layer (16).

4. The shoe upper as claimed in one of claims 1 to 3, with a lining arranged on the inner side of the functional layer (16).

5. The shoe upper as claimed in claim 4, in which the functional layer (16) and the lining (18) are equally long in the bottom end region of the upper.

6. The shoe upper as claimed in claim 5, in which the functional layer (16) and the lining (18) end above the bottom longitudinal side (25) of the joining strip.

7. The shoe upper as claimed in claim 6, in which the functional layer (16) and the lining (18) end above the bottom longitudinal side (25) of the joining strip and are lengthened by a second joining strip (34) in the direction of the bottom end of the upper.

8. The shoe upper as claimed in claim 7, in which the second joining strip (34) consists of liquefiable sealing material or of material through which liquid sealing material (37; 41) can flow and has at points of curvature of the bottom end of the upper an arcuate shape corresponding to the local radius of curvature, with different degrees of curvature of its two longitudinal sides of the joining strip, in such a way that, for an arc sector lying in the respective curvature, with a predetermined unitary sector angle, the arc lengths belonging to this arc sector of the two longitudinal sides (36, 38) of the second joining strip (34) differ from each other all the more the

greater the curvature in the arc sector respectively being considered.

9. The shoe upper as claimed in claim 7 or 8, in which a bottom longitudinal side (38) of the second joining strip (34) is joined to the bottom longitudinal side (25) of the first joining strip (17).

10. The shoe upper as claimed in claim 4, in which the bottom end of the lining is longer than the bottom end of the functional layer.

11. The shoe upper as claimed in claim 10, in which the bottom end of the lining is joined to the bottom longitudinal side (25) of the first joining strip (17).

12. The shoe upper as claimed in claim 10 or 11, in which the functional layer (16) and the lining (18) are parts of a laminate and the bottom end of the functional layer is shortened in comparison with the bottom end of the lining by paring of the functional layer (16).

13. The shoe upper as claimed in one of claims 1 to 12, with an insole (33) joined to the bottom end of the upper.

14. The shoe upper as claimed in claim 13, the insole (33) being joined to the bottom longitudinal side (25) of the first joining strip (17).

15. The shoe upper as claimed in claim 13 or 14 in conjunction with one of claims 7 to 9, the insole (33) being joined to the bottom longitudinal side of both the first and the second joining strip (34).

16. The shoe upper as claimed in claim 13 or 14 in conjunction with one of claims 10 to 12, the insole (33) being joined to the bottom end of the lining.

17. The shoe upper as claimed in one of claims 1 to 16, in which, at points of the bottom end of the upper with convex curvature, the arc length of the top longitudinal side (23) of the first joining strip (17) is longer than the arc length of the bottom longitudinal side of said joining strip.

18. The shoe upper as claimed in one of claims 1 to 17, in which, at points of the bottom end of the upper with concave curvature, the arc length of the bottom longitudinal side (25) of the first joining strip (17) is longer than the arc length of the top longitudinal side of said joining strip.

19. The shoe upper as claimed in one of claims 1 to 18 in conjunction with claim 8 or 9, in which, at points of the bottom end of the upper with convex curvature, the arc length of the top longitudinal side (23) of the second joining strip (34) is longer than the arc length of the bottom longitudinal side of said joining strip.

20. The shoe upper as claimed in one of claims 1 to 19 in conjunction with one of claims 7 to 9, in which, at points of the bottom end of the upper with concave curvature, the arc length of the bottom longitudinal side of the second joining strip (34) is longer than the top longitudinal side of said joining strip.

21. The shoe upper as claimed in one of claims 1 to 20, in which the functional layer zone (20) not covered by outer material (13) is formed by an

overhang of the end region (21) of the functional layer with respect to the end (19) of the outer material.

22. The shoe upper as claimed in one of claims 1 to 21, in which the bottom longitudinal side (25) of the first joining strip (17) is joined to a bottom border of the functional layer.

23. The shoe upper as claimed in one of claims 1 to 22, with a substantially rigid joining strip (17), in which the differences in arc length, dependent on the respective arc curvature, of the two longitudinal sides (23, 25) of the joining strip are incorporated by corresponding production.

24. The shoe upper as claimed in claim 23, with a punched joining strip (17).

25. The shoe upper as claimed in claim 23, with an injection-molded joining strip (17).

26. The shoe upper as claimed in one of claims 1 to 22, with an elastically extensible joining strip (17), which is joined on at least one of its longitudinal sides (23, 25) to the associated material under longitudinal tensile prestress.

27. The shoe upper as claimed in one of claims 1 to 22, with a deformable joining strip, which is joined on at least one of its longitudinal sides (23, 25) to the associated material under longitudinal tensile prestress leading to plastic deformation.

28. The shoe upper as claimed in one of claims 1 to 22, 26 and 27, in which the joining strip (17) is joined on its bottom longitudinal side to the

associated material under longitudinal tensile prestress.

29. The shoe upper as claimed in one of claims 1 to 28, in which the first longitudinal side (23) of the joining strip (17) is sewn to the end (19) of the outer material.

30. The shoe upper as claimed in one of claims 1 to 29, in which the bottom longitudinal side (25) of the joining strip (17) is sewn to the functional layer (16).

31. The shoe upper as claimed in one of claims 1 to 30, the joining strip (17) of which is non-porous.

32. The shoe upper as claimed in claim 31, the joining strip (17) of which is constructed with a sealing material (37) which can be activated by means of activation energy, selected from the forms of energy thermal energy, high-frequency energy, infrared energy and UV energy, into a temporarily liquid state.

33. The shoe upper as claimed in claim 31 for footwear with a molded-on sole, the joining strip (17) of which consists of a material which can be melted by sole material which is hot-liquid during the molding-on of the sole.

34. The shoe upper as claimed in one of claims 31 to 33, the joining strip (17) of which is formed by a polyurethane strip.

35. The shoe upper as claimed in one of claims 1 to 30, the joining strip (17) of which is porous in such a way that it can be penetrated by liquid sealing material (37; 41).

36. The shoe upper as claimed in claim 35, the joining strip (17) of which is formed by a gauze strip, which has a top longitudinal web (23) on its top longitudinal side and a bottom longitudinal web (25) on its bottom longitudinal side, which webs are joined to each other by means of transverse webs (27).

37. The shoe upper as claimed in claim 36, in which at least the bottom longitudinal web (25) is constructed with elastically compliant material.

38. The shoe upper as claimed in claim 36 or 37, in which the transverse webs (27) are constructed with non-elastic material.

39. The shoe upper as claimed in one of claims 36 to 38, in which the gauze strip is woven, longitudinal threads, serving as warp threads, of which at least some are elastic, at least with regard to the top longitudinal web (23), being present only in the regions of the longitudinal webs (23, 25), and the transverse webs (27) being formed by weft threads.

40. The shoe upper as claimed in one of claims 1 to 12 and 17 to 39, in which the bottom longitudinal side (25) of the first joining strip (17) is joined to a string-lasting tunnel (47), arranged in which is a lashing string (49), which is longitudinally movable in relation to the string-lasting tunnel (47) and by the lashing together of which the bottom end region of the upper is tensioned in the inward direction in such a way that the bottom end region of the upper with the joining strip (17) run in the direction of the extent of an outsole (41) still to be applied.

41. The shoe upper as claimed in claim 40, in which the bottom end of the functional layer or the bottom end of the lining or the bottom longitudinal side (38) of the second joining strip (34) is joined to a string-lasting tunnel (47), arranged in which is a lashing string (49), which is longitudinally movable in relation to the string-lasting tunnel (47).

42. The shoe upper as claimed in claim 41, in which the bottom longitudinal side (25) of the first joining strip (17) and the bottom end of the functional layer or the bottom end of the lining or the bottom longitudinal side (38) of the second joining strip (34) are joined to one and the same string-lasting tunnel (47).

43. The shoe upper as claimed in one of claims 1 to 42, the functional layer (16) of which is water-vapor-permeable.

44. The shoe upper as claimed in claim 43, the functional layer (16) of which has a layer of microporous PTFE.

45. The shoe upper as claimed in one of claims 26 to 44, the joining strip (17) of which has an extensibility of at least 20%.

46. Footwear with a shoe upper as claimed in one of claims 1 to 45.

47. The footwear as claimed in claim 46, with a sealing material (37; 41), which seals the functional layer zone (20) in a waterproof manner in a sealing material zone that runs around in the peripheral direction of the bottom end of the upper.

48. The footwear as claimed in claim 47 with a molded-on sole, the sealing material of which is formed by sole material (41) which is liquid during the molding-on of the sole and, by penetrating through the porous first joining strip (17), seals in a waterproof manner at least part of the width of the functional layer zone (20).

49. The footwear as claimed in claim 47, the sealing material (37) of which is formed by adhesive which leads to waterproofness in the cured state and, by penetrating through the porous first joining strip (17), seals in a waterproof manner at least part of the width of the functional layer zone (20).

50. The footwear as claimed in claim 49, with sealing material (37) in the form of reactive hot-melt adhesive, which leads to waterproofness in the fully reacted state.

51. The footwear as claimed in one of claims 46 to 50, with an insole (33), the bottom end of the upper and the functional layer zone (20) running in the direction of the extent of the insole (33).

52. The footwear as claimed in claim 51, in which the insole (33) is joined to the functional layer (16) and the bottom longitudinal side of the first joining strip (17) by means of a Strobel seam (35).

53. The footwear as claimed in claim 51, in which the bottom end of the upper is lasted by means of lasting cement (45) onto a bottom peripheral border of the insole (33).

54. The footwear as claimed in one of claims 46 to 53, with a sheet-like waterproof sealing layer, which is applied to the underside of the bottom end of

the upper such that it extends parallel to a still to be applied sole (41) in such a way that a bottom opening of the upper is sealed as far as the sealing material zone.

55. The footwear as claimed in claim 54, in which the sealing layer is formed by a sealing sheet (39), which is cemented onto the underside of the insole.

56. The footwear as claimed in claim 55, the sealing sheet (39) of which has a waterproof functional layer (16).

57. A process for producing a shoe upper, which is constructed with an outer material (13) and a waterproof functional layer (16) arranged on the inner side of the outer material (13) and has a bottom end of the upper, with the following production steps:
an outer-material piece cut in the form of the upper is provided;
a functional-layer piece cut in the form of the upper is provided, cut in such a way that a bottom end region of the functional-layer piece has a functional layer zone (20) that is not covered by the outer material (13) after the functional-layer piece has been arranged in the correct position on the inner side of the outer-material piece;
the bottom border of the outer-material piece is joined over its entire periphery to a top longitudinal side (23) of a joining strip (17) consisting of liquefiable sealing material or of material through which liquid sealing material (37; 41) can flow;
the joining strip (17) being provided at points of curvature of the bottom end of the upper with an arcuate shape corresponding to the local radius of curvature, with different degrees of curvature of

the two longitudinal sides (23, 25) of the joining strip, in such a way that, for an arc sector lying in the respective curvature, with a predetermined unitary sector angle, the arc lengths belonging to this arc sector of the two longitudinal sides (23, 25) of the joining strip differ from each other all the more the greater the curvature in the arc sector respectively being considered.

58. The process as claimed in claim 57, in which the bottom longitudinal side (25) of the joining strip is joined to the functional layer (16).

59. The process as claimed in claim 57, in which a region of the joining strip (17) located between the two longitudinal sides (23, 25) of the joining strip is joined to the functional layer (16).

60. The process as claimed in one of claims 57 to 59, in which a lining (18) is arranged on the inner side of the functional layer (16).

61. The process as claimed in claim 60, in which the functional layer (16) and the lining (18) are made equally long at the bottom end of the upper.

62. The process as claimed in claim 61, in which the functional layer (16) and the lining (18) are made to end above the bottom longitudinal side (25) of the joining strip.

63. The process as claimed in claim 62, in which the functional layer (16) and the lining (18) are lengthened by a second joining strip (34) in the direction of the bottom end of the upper.

64. The process as claimed in claim 63, in which a second joining strip (34) consisting of liquefiable sealing material or of material

through which liquid sealing material (37; 41) can flow is used and has at points of curvature of the bottom end of the upper an arcuate shape corresponding to the local radius of curvature, with different degrees of curvature of its two longitudinal sides (36, 38) of the joining strip, in such a way that, for an arc sector lying in the respective curvature, with a predetermined unitary sector angle, the arc lengths belonging to this arc sector of the two longitudinal sides (36, 38) of the second joining strip (34) differ from each other all the more the greater the curvature in the arc sector respectively being considered.

65. The process as claimed in claim 63 or 64, in which a bottom longitudinal side (38) of the second joining strip (34) is joined to the bottom longitudinal side (25) of the first joining strip (17).

66. The process as claimed in claim 60, in which the bottom end of the lining is made longer than the bottom end of the functional layer.

67. The process as claimed in claim 66, in which the bottom end of the lining is joined to the bottom longitudinal side (25) of the first joining strip (17).

68. The process as claimed in claim 66 or 67, in which a laminate comprising the functional layer (16) and the lining (18) is used and the bottom end of the functional layer is shortened in comparison with the bottom end of the lining by paring of the functional layer (16).

69. The process as claimed in one of claims 57 to 68, in which the bottom end of the upper is is joined to an insole (33).

70. The process as claimed in claim 69, in which the insole (33) is joined to the bottom longitudinal side (25) of the first joining strip (17).

71. The process as claimed in claim 69 or 70 in conjunction with one of claims 64 to 66, in which the insole (33) is joined to the bottom longitudinal side of both the first and the second joining strip (34).

72. The process as claimed in claim 70 or 71 in conjunction with one of claims 66 to 68, in which the insole (33) is joined to the bottom end of the lining.

73. The process as claimed in one of claims 57 to 72, in which, at points of the bottom end of the upper with convex curvature, the arc length of the top longitudinal side (23) of the joining strip is made longer than the arc length of the bottom longitudinal side (25) of the joining strip.

74. The process as claimed in one of claims 57 to 74, in which, at points of the end of the upper with concave curvature, the arc length of the bottom longitudinal side (25) of the joining strip is made longer than the arc length of the top longitudinal side (23) of the joining strip.

75. The process as claimed in one of claims 57 to 74, in which the functional layer zone (20) is formed by an overhang of the functional layer (16) with respect to the lower border of the outer-material piece (19).

76. The process as claimed in one of claims 57 to 75, using a substantially rigid joining strip (17), in which the differences in arc length, dependent on

the respective arc curvature, of the two longitudinal sides (23, 25) of the joining strip are incorporated by corresponding production.

77. The process as claimed in claim 76, using a punched joining strip (17).

78. The process as claimed in claim 76, using an injection-molded joining strip (17).

79. The process as claimed in one of claims 57 to 75, using an elastically extensible joining strip (17), which is joined on at least one of its longitudinal sides (23, 25) to the associated material under longitudinal tensile prestress.

80. The process as claimed in one of claims 57 to 75, using a non-elastically extensible joining strip (17), which is joined on at least one of its longitudinal sides (23, 25) to the associated material under longitudinal tensile prestress leading to plastic deformation.

81. The process as claimed in one of claims 57 to 75, 79 and 80, in which the bottom end of the border of the functional layer is joined to the bottom longitudinal side of the extensible joining strip (17) under longitudinal tensile prestress of the joining strip (17) leading to elastic or non-elastic deformation.

82. The process as claimed in one of claims 57 to 81, using a joining strip (17) which is constructed with a sealing material (37) which can be activated by means of activation energy, selected from the forms of energy thermal energy, high-frequency energy, infrared energy and UV energy, into a temporarily liquid state.

83. The process as claimed in one of claims 57 to 81, using a joining strip (17) consisting of a material which can be melted by sole material which is hot-liquid during the molding-on of the sole (41).

84. The process as claimed in claim 82 or 83, using a joining strip (17) formed by a polyurethane strip.

85. The process as claimed in one of claims 57 to 81, using a porous joining strip (17) which can be penetrated by liquid sealing material (37; 41).

86. The process as claimed in one of claims 57 to 81, in which a gauze strip is used as the joining strip (17), which gauze strip has a top longitudinal web (23) on its top longitudinal side and a bottom longitudinal web (25) on its bottom longitudinal side, which webs are joined to each other by means of transverse webs (27).

87. The process as claimed in claim 86, a gauze strip in which at least the bottom longitudinal web (25) is constructed with elastically compliant material being used.

88. The process as claimed in claim 86 or 87, a gauze strip in which the transverse webs (27) are constructed with non-elastic material being used.

89. The process as claimed in one of claims 79 to 88, in which a joining strip (17) with an extensibility of at least 20% is used.

90. The process as claimed in one of claims 57 to 89, in which the bottom end of the lining border and the bottom longitudinal side (25) of the joining strip (17) are joined to a string-lasting tunnel (47), which receives a lashing string (49) which

is longitudinally movable in relation to the string-lasting tunnel (47), and, by lashing together of the lashing string (49), a bottom end region of the upper is tensioned with the lining border and the joining strip (17) in the inward direction in such a way that the bottom end region of the upper with the lining border and the joining strip (17) run in the direction of the extent of a sole (41) still to be applied.

91. The process as claimed in one of claims 57 to 90, in which the functional layer zone (20) is sealed in a waterproof manner by a sealing material (37; 41) in a sealing material zone that runs around in the peripheral direction of the end of the upper.

92. A process for producing footwear, using a shoe upper which has been produced by the process as claimed in one of claims 57 to 91.

93. The process as claimed in claim 92, in which there is molded onto the upper (11) a sole (41) of sole material which is liquid during the molding-on and, by penetrating through the porous joining strip (17), seals in a waterproof manner at least part of the width of the functional layer zone (20).

94. The process as claimed in claim 92, using a sealing material (37) in the form of a sealing adhesive which leads to waterproofness in the cured state and, by penetrating through the porous joining strip (17), seals in a waterproof manner at least part of the functional layer zone (20).

95. The process as claimed in claim 94, using a sealing material (37) in the form of reactive hot-melt adhesive, which leads to waterproofness in the fully reacted state.

96. The process as claimed in one of claims 92 to 95, in which a bottom end region of the upper is aligned in such a way that it runs in the direction of the extent of an outsole (41) still to be applied, and the bottom end region of the upper is joined to an insole (33).

97. The process as claimed in claim 96, in which the join to the insole (33) is produced by means of a Strobel seam (35).

98. The process as claimed in claim 96, in which the join to the insole (33) is produced by means of a lasting operation using lasting cement (45).

99. The process as claimed in one of claims 92 to 98, in which a sheet-like waterproof sealing layer, which seals a bottom opening of the upper as far as the sealing material zone, is applied to the underside of the end region of the upper turned back in the direction of the extent of the sole.

100. The process as claimed in claim 99, in which a sealing sheet (39) is cemented onto the underside of the insole as the sealing layer.

Abstract

Shoe upper having a bottom end of the upper, an outer material with a bottom end (19) of the outer material, a waterproof functional layer (16), which has a bottom end region of the functional layer with a functional layer zone (20) not covered by outer material, and a joining strip (17), which runs in the peripheral direction of the upper, has a top longitudinal side (23) of the joining strip, joined to the end (19) of the outer material, and a bottom longitudinal side (25) of the joining strip, at least partially overlaps the functional layer zone (20) and consists of liquefiable sealing material or of material through which liquid sealing material (37; 41) can flow, the joining strip (17) having at points of curvature of the bottom end (19) of the outer material an arcuate shape corresponding to the local radius of curvature, with different degrees of curvature of the two longitudinal sides (23, 25) of the joining strip, in such a way that, for an arc sector lying in the respective curvature, with a predetermined unitary sector angle, the arc lengths belonging to this arc sector of the two longitudinal sides (23) of the joining strip differ from each other all the more the greater the curvature in the arc sector respectively being considered.

(Figure 3)